TECHNICAL MEMORANDUM

TO: Mr. Lawrence Gaboury
Second Vice President
John Hancock Mutual Life Insurance Company

FROM: Robert D. Klimm, Associate
HMM Associates, Inc.

DATE: January 16, 1989

SUBJECT: TRAFFIC IMPACTS OF THE HERALD STREET EXTENSION ON THE INTERSECTION OF COLUMBUS AVENUE AND CLARENDON STREET

A. SUMMARY OF FINDINGS

The additional analyses performed by HMM respond to the BTD's concern about the impact of the Hancock proposal on Herald Street with an eastbound access ramp to the Massachusetts Turnpike. HMM's previous study analyzed year 2010 conditions including a one-way Herald Street Extension, but without an eastbound connector to the Massachusetts Turnpike. This was not previously analyzed since both City and State suggested the geometrics of the Massachusetts Turnpike merge lane were a problem.

The findings of our supplemental effort support the initial Level of Service (LOS) conclusions reached in July 1988. Last summer we concluded that the Columbus Avenue/Clarendon Street intersection would function at LOS D for year 2010 conditions with the project, which meant that with the addition of site traffic and Herald Street, Columbus/Clarendon traffic delays were within the acceptable range.

The data supplied by CTPS and Bruce Campbell & Associates shows a LOS D during the year 2010 AM peak hour and a LOS C during the PM peak hour at the Columbus Avenue/Clarendon Street intersection. Comparisons with this and other technical analyses confirms that HMM's conclusions are very conservative if not a "worst-case" scenario, which supports our earlier findings.

B. BACKGROUND

HMM Associates, Inc. (HMM) prepared a traffic study for the proposed Hancock Garage and Office Complex in July, 1988*. The focus of this study was to establish an updated traffic baseline condition, upon which potential project-related traffic impacts could begin to be assessed. This study was not intended to be a detailed Transportation Access Plan (required by the City under Article 31), but to evaluate the potential impacts of the project on adjacent areas.

The July, 1988 study analyzed traffic operations for 1988 existing conditions and for 1991 conditions with and without the proposed project. Both the 1988 and 1991 analyses assumed no major changes to the existing roadway network.

In addition, since the City and State were at that time (i.e., June-July 1988) in the process of analyzing alternative roadway changes as part of the Central Artery/Third Harbor Tunnel project, an additional analysis was conducted for year 2010 conditions, assuming the implementation of these improvements. Based upon discussions with the Boston Transportation Department (BTD), HMM contacted the City's traffic consultant - Bruce Campbell & Associates - and received the latest year 2010 projections which were based upon completion of the following roadway projects:

- Third Harbor Tunnel/Central Artery Project;
- New westbound off-ramp from the Massachusetts Turnpike to Berkeley Street;
- Tremont Street/Arlington Street one-way loop system; and
- Herald Street Extension continuing to Columbus Avenue or Clarendon Street.

It was indicated by the City's BTD that this alternative, designated as Alternative P-3, was the preferred alternative at the time, as should be used by HMM in our analysis of the Herald Street Extension. Accordingly, HMM used Alternative P-3 to analyze year 2010 operations at the Clarendon Street/Columbus Avenue intersection. The results of the analyses were presented in the July 1988 report, and indicated that, using the Alternative P-3 volumes with the proposed project, the Herald Street Extension, if terminated at Columbus Avenue, would result in design year operations of Level of Service (LOS) C. This LOS was within an acceptable range, and it was concluded that the Herald Street Extension could be terminated at Columbus Avenue, rather than extend further to Clarendon Street.

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* Hancock Garage and Office Complex Traffic Study, HMM Associates, Inc., July 22, 1988.

The July 22, 1988 report was submitted to the BTD for their review. A review meeting with the BTD was held on August 10, 1988 to discuss the report's conclusions. A subsequent meeting with the BTD was held on December 21, 1988.

As indicated by Ted Siegel and Chi-Hsin Shao of the BTD at the December 21st Meeting, the City was interested in an additional evaluation of future traffic operations at the Clarendon Street/Columbus Avenue intersection under the following year 2010 conditions:

1. Completion of the Herald Street Extension, one-way, eastbound;
2. Completion of a westbound off-ramp from the Massachusetts Turnpike to Berkeley Street; and
3. Completion of an eastbound on-ramp to the Massachusetts Turnpike from the Herald Street Extension.

The previous July 1988 analyses conducted by HMM included items 1 and 2 above; but did not include item 3, the Massachusetts Turnpike eastbound on-ramp, since the City indicated during the course of our initial study that construction of this ramp was unlikely due to State DPW concerns about geometric constraints.

C. SUPPLEMENTAL YEAR 2010 TRAFFIC ANALYSES

As discussed at the December 21, 1988 meeting with the BTD, HMM adjusted the previously used year 2010, Alternative P-3 volumes to include an eastbound on-ramp to the Massachusetts Turnpike. A conservative approach was taken during the reassignment of network volumes so as to reflect a "worst-case" condition, in terms of potential Herald Street Extension volumes.

In addition, as requested by Chi-Hsin Shao of the BTD at the December 21st meeting, an analyses was performed to estimate capacity flows at the Clarendon Street/Columbus Avenue intersection, under the year 2010 conditions with the eastbound on-ramp to the Massachusetts Turnpike.

The traffic volumes associated with the adjustments to the year 2010, Alternative P-3 volumes (with the eastbound on-ramp to the Massachusetts Turnpike) and the subsequent capacity analysis for the conditions, are presented in Attachments 1 and 2. Level of Service analyses for these conditions resulted in the following:

Location	Peak Hour	Year 2010 LOS*
Columbus Avenue at Clarendon Street	PM-Design Hour	D (30.5 sec/veh)

For comparative purposes, the previous analysis presented in the July 1988 report, which included an assessment of Alternative P-3 without the eastbound Massachusetts Turnpike on-ramp resulted in LOS C (15.8 sec/veh) at this intersection for the PM design hour.

Following the completion of this subsequent analysis, as requested by the BTD, HMM scheduled a meeting with representatives of BCA and Cambridge Systematics to discuss the resultant volumes, in light of work on-going as part of the City's Back Bay Traffic Study. A meeting was scheduled on January 11, 1989 at the BCA offices in Boston. Mr. George Bezkorovani represented BCA, and Mr. Robert LaPorte of Cambridge Systematics, although scheduled to attend, did not attend the meeting, but was contacted by telephone during the meeting.

At this January 11th meeting, the rationale for the reassignment of year 2010, Alternative P-3 volumes, including the eastbound on-ramp to the Massachusetts Turnpike, was discussed. It was generally agreed that the volumes developed by HMM represented a conservative estimate of the PM peak hour design flows. Mr. Bezkorovani presented year 2010 volumes which had been computer-generated by the Central Transportation Planning Staff (CTPS) which included both the Herald Street Extension and an eastbound on-ramp to the Massachusetts Turnpike. The CTPS volumes were developed for both the AM and PM peak hours. These volumes were reviewed and it was decided that it was appropriate to also evaluate the CTPS volumes at the intersection of Clarendon Street and Columbus Avenue for comparative purposes.

Accordingly, HMM performed peak hour Level of Service analyses at the Clarendon Street/Columbus Avenue intersection using the CTPS computer-generated volumes, assuming that the Herald Street Extension would not directly connect to Clarendon Street but will extend to Columbus Ave. (The volumes used for these analyses are presented in Attachment 2.) The analyses indicated that, using the year 2010 peak hour volumes, the intersection of Clarendon

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* The Alternative P-3 traffic volumes were adjusted by HMM to include an eastbound on-ramp to the Massachusetts Turnpike. Due to the heavy left turn volume we propose that the Clarendon Street lane assignments be revised to double left and one thru-right turn (L,L, TR). The existing signal heads, lane markings, and signal timing will need to be revised due to the double left turn lane arrangement.

Street and Columbus Avenue will operate at LOS D (38.6 sec/veh) during the AM peak hour, and LOS C (17.9 sec/veh) during the PM peak hour. Again, both of these results assume that the Herald Street Extension will terminate at Columbus Avenue.

A summary of the analyses results are presented in Table 1 for the different year 2010 volumes analyzed. The projected peak hour levels of service for the Columbus Avenue/Clarendon Street intersection will be "D" or better for the Alternative P-3 reassigned volumes, or the CTPS volumes supplied to us for the 2010 design year. This analysis is based upon full site development, construction of Herald Street to Columbus Avenue, construction of the eastbound Mass Pike on-ramp, and revising the lane assignments on Clarendon Street at Columbus Avenue.

In summary, we feel that the Herald Street Extension would be able to terminate at Columbus Avenue without having an adverse affect on traffic operations at Columbus Avenue/Clarendon Street.

TABLE 1

YEAR 2010 LEVEL OF SERVICE AND VOLUME SUMMARY:
HERALD STREET EXTENSION WITH EASTBOUND ON-RAMP
TO THE MASSACHUSETTS TURNPIKE

Location	2010 PM Design Hour Volumes - HMM/BCA[1]		2010 AM Peak Hour Volumes - CTPS[2]		2010 PM Peak Hour Volumes - CTPS[2]	
	Peak Hour Volume	Level of Service	Peak Hour Volume	Level of Service	Peak Hour Volume	Level of Service
Columbus Ave. @ Clarendon St.	3193	D (30.5 sec/veh)	2949	D (38.6 sec/veh)	2791	C (17.9 sec/veh)
Herald St. Extension	1001	--------	1264	--------	600	--------

Source: 1 Developed by HMM based upon a reassignment of volumes prepared by BCA.

2 Link flows conputer-generated by the Central Transportation Planning Staff. Turning movements along approaches developed by HMM.

ATTACHMENT 1*:

PEAK DESIGN HOUR VOLUMES AND OPERATIONS FOR YEAR 2010,
ALTERNATIVE P-3, WITH AN ESTIMATED ON-RAMP
TO THE MASSACHUSETTS TURNPIKE

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* Source: Volumes developed by HMM based upon a reassignment of year 2010, Alternative P-3 volumes prepared by BCA.

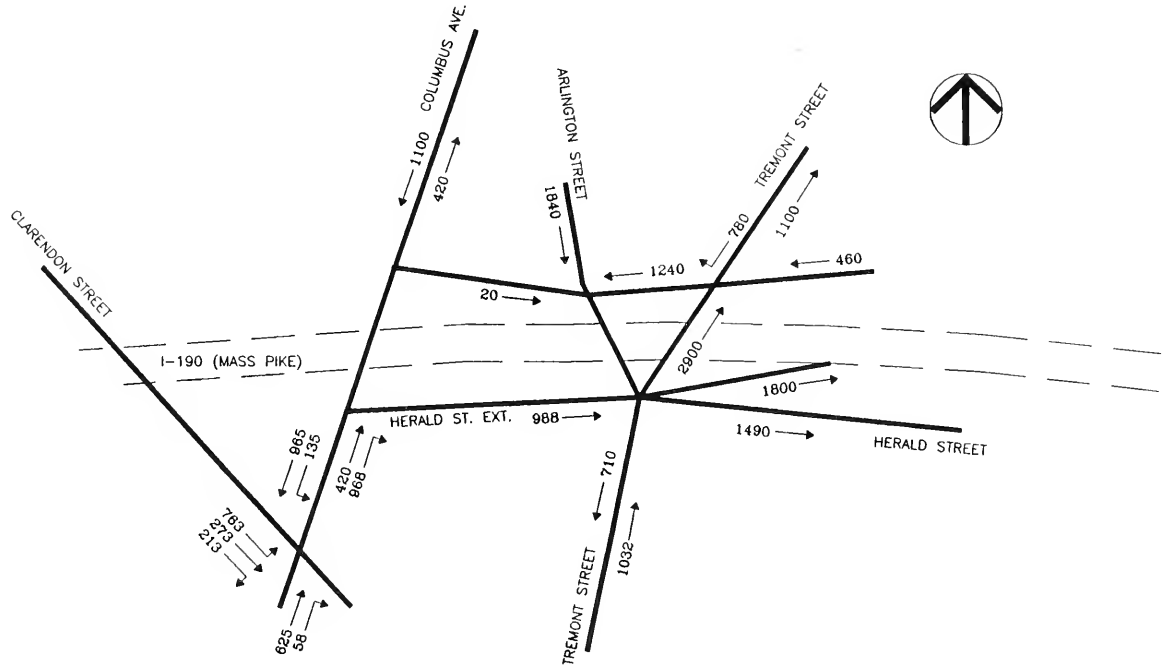

FIGURE 1
2010 NO-BUILD TRAFFIC VOLUMES
PM PEAK HOUR

…CTION :
…S AVE. w
…ON ST.
PM PEAK HOUR 10 NB DOLI CBD?Y
…D SIGNAL

T R A F F I C & R O A D W A Y C O N D I T I O N S

GRADE (%)	HV (%)	ADJ. PKG LN. Y/N	Nm	BUSES (Nb)	PHF	CONF. PEDS (peds/hr)	PED BUTTON Y/N	SEC	ARR TYPE
0	3	Y	10	0	0.89	0	Y	12.5	3
0	4	Y	10	0	0.87	0	Y	9.2	3
0	0	N	0	0	0.90	0	N	0.0	3
0	0	N	0	0	0.89	0	Y	17.0	3

G E O M E T R I C S / V O L U M E S

VOLUME LT	VOLUME TH	VOLUME RT	LANE GROUP 1 MVM	LANE GROUP 1 LNS	LANE GROUP 1 WD	LANE GROUP 2 MVM	LANE GROUP 2 LNS	LANE GROUP 2 WD	LANE GROUP 3 MVM	LANE GROUP 3 LNS	LANE GROUP 3 WD
0	475	58	T	1	11.0	TR	1	12.0			
155	765	0	LT	1	14.0	T	1	14.0			
0	0	0									
763	273	213	L	2	24.0	TR	1	17.0			

S I G N A L P H A S I N G

PHASE	1ST MV	2ND MV	3RD MV	PROT	PMSV	G	Y+R
1	T	TR		R		54	46
1	LT	T			L	54	46
2	L	TR		LR		40	60

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5 AVE. &
ON ST.
PM PEAK HOUR 10 NB PDLL CBD ' '
D SIGNAL

V O L U M E A D J U S T M E N T

MVM	LANE GROUP VOLUME	FLOW RATE IN GROUP	LANE UTIL FACTOR	ADJ FLOW RATE	PROP OF TURNS LT	RT
T	342	384	1.00	384	0.00	0.00
TR	341	383	1.00	383	0.00	0.37
LT	415	477	1.00	477	0.33	0.00
T	685	787	1.00	787	0.00	0.00
L	763	857	1.00	857	1.00	0.00
TR	486	546	1.00	546	0.00	0.44

S A T U R A T I O N F L O W

IDEAL SAT FLOW	# OF LANES	ADJUSTMENT FACTORS WIDTH	H.V.	GRADE	PARK	BUS	AREA	RT	LT	ADJ. FLOW
1800	1	0.97	0.97	1.00	1.00	1.00	0.90	1.00	1.00	1524
1800	1	1.00	0.97	1.00	0.85	1.00	0.90	0.97	1.00	1302
1900	1	1.07	0.98	1.00	1.00	1.00	0.90	1.00	0.60	1019
1900	1	1.07	0.98	1.00	0.85	1.00	0.90	1.00	1.00	1444
1800	2	1.00	1.00	1.00	1.00	1.00	0.90	1.00	0.92	2981
1800	1	1.00	1.00	1.00	1.00	1.00	0.90	0.93	1.00	1513

HMM ASSOCIATES 1/11/1989

HANCOCK DEVELOPMENT 10: LOL

TION :
AVE S
N ST.
PM PEAK HOUR 10 NB DOL. CBD ? Y
SIGNAL

C A P A C I T Y A N A L Y S I S

GR M	ADJ FLOW RATE	PMRV LT FLOW	ADJ SAT FLW RT	FLOW RATIO	CRIT ?	GREEN RATIO	LN GR CAPACITY	V/L RATIO
	384	0	1521	0.252	N	0.540	823	0.467
	383	0	1302	0.294	N	0.540	703	0.545
	477	0	1019	0.468	N	0.540	550	0.867
	757	0	1444	0.545	Y	0.540	780	1.009
	857	0	3981	0.287	N	0.400	1192	0.719
	546	0	1513	0.361	Y	0.400	605	0.902

NGTH : 100.0 SUM OF CRITICAL LANES' FLOW RATIOS : 0.906
E PER CYCLE : 6 INTERSECTION V/C : 0.964

L E V E L O F S E R V I C E

GR M	V/C RATIO	GREEN RATIO	CYC LEN	1st DELAY	LN GR CAP	2nd DELAY	PF	LN GR DELAY	LN GR LOS	APP DELAY	APP LOS
	0.467	0.540	100	10.8	823	0.3	0.85	9.4	B		
R	0.545	0.540	100	11.4	703	0.7	0.85	10.3	B	9.8	B
T	0.867	0.540	100	15.1	550	9.6	0.85	21.0	C		
	1.009	0.540	100	17.7	780	27.0	0.85	38.9	D	31.6	D
	0.719	0.400	100	19.2	1192	1.5	1.00	20.7	C		
R	0.902	0.400	100	21.4	605	12.0	0.85	28.4	D	23.7	C

INTERSECTION DELAY : 23.5 secs/veh
LEVEL OF SERVICE : C

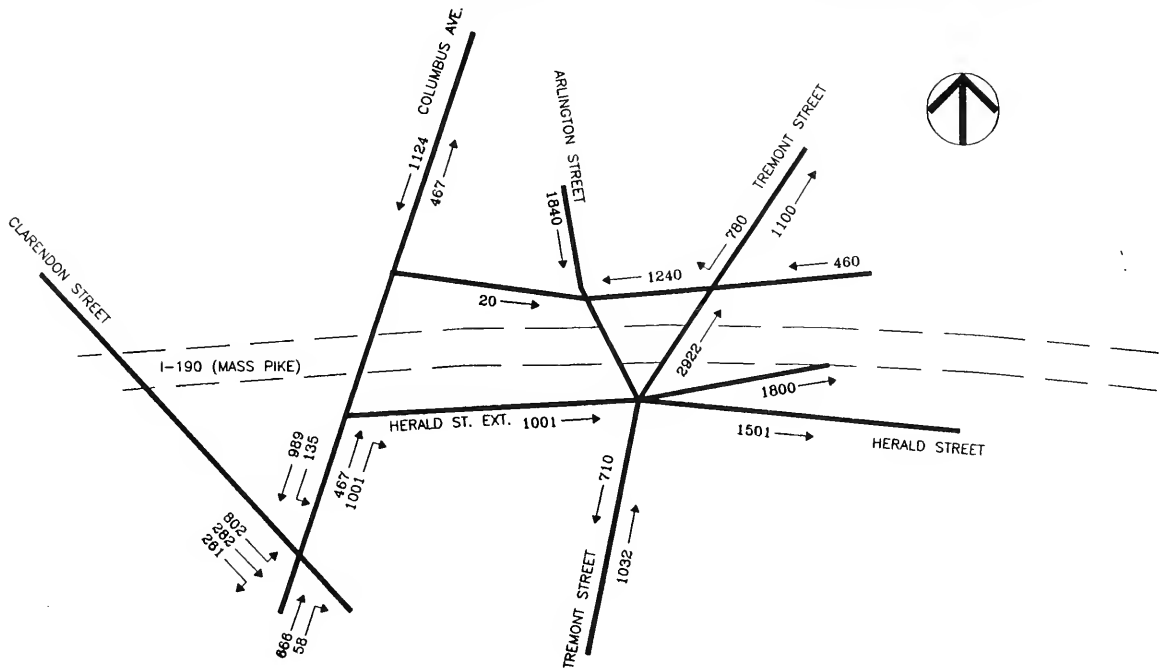

FIGURE 2
2010 BUILD TRAFFIC VOLUMES
PM PEAK HOUR

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CTION :
S AVE. &
ON ST.
PM PEAK HOUR TO B OCLL COPY
D SIGNAL

T R A F F I C & R O A D W A Y C O N D I T I O N S

GRADE (%)	HV (%)	ADJ. PKG LN. Y/N	PKG LN. Nm	BUSES (Nb)	PHF	CONF. PEDS (/hr)	PED BUTTON Y/N	PED BUTTON SEC	ARR TYPE
0	8	Y	10	0	0.89	0	Y	12.5	3
0	4	Y	10	0	0.87	0	Y	9.7	3
0	0	N	0	0	0.90	0	N	0.0	3
0	0	N	0	0	0.89	0	Y	17.0	3

D E F I N I T I O N S / V O L U M E S

VOLUME LT	VOLUME TH	VOLUME RT	LANE GROUPS 1 MVM	1 LNS	1 WD	2 MVM	2 LNS	2 WD	3 MVM	3 LNS	3 WD
0	466	58	T	1	11.0	TR	1	12.0			
135	989	0	LT	1	14.0	T	1	14.0			
0	0	0									
302	382	261	L	1	24.0	TR	1	12.0			

S I G N A L P H A S I N G

PHASE	1ST MV	2ND MV	3RD MV	PROT	PMSV	G	Y+R
1	T	TR		R		58	42
3	LT	T			L	58	42
2	L	TR		LR		36	64

TION :
AVE. @
N ST.
PM PEAK HOUR 10 B DDLL CBD ? Y
SIGNAL

V O L U M E A D J U S T M E N T

LANE GROUP MVM	VOLUME	FLOW RATE IN GROUP	LANE UTIL FACTOR	ADJ FLOW RATE	PROP OF TURNS LT	RT
T	362	407	1.00	407	0.00	0.00
TR	362	407	1.00	407	0.00	0.16
LT	500	575	1.00	575	0.27	0.00
T	624	717	1.00	717	0.00	0.00
L	802	901	1.00	901	1.00	0.00
TR	543	610	1.00	610	0.00	0.48

S A T U R A T I O N F L O W

IDEAL SAT FLOW	# OF LANES	ADJUSTMENT FACTORS WIDTH	H.V.	GRADE	PARK	BUS	AREA	RT	LT	ADJ. FLOW
1800	1	0.97	0.97	1.00	1.00	1.00	0.90	1.00	1.00	1524
1800	1	1.00	0.97	1.00	0.85	1.00	0.90	0.98	1.00	1304
1800	1	1.07	0.98	1.00	1.00	1.00	0.90	1.00	0.63	1070
1800	1	1.07	0.98	1.00	0.85	1.00	0.90	1.00	1.00	1444
1800	2	1.00	1.00	1.00	1.00	1.00	0.90	1.00	0.92	2981
1800	1	1.00	1.00	1.00	1.00	1.00	0.90	0.93	1.00	1503

CTION :
S AVE. @
ON ST.
PM PEAK HOUR 10 B 1 D' L CRD ? Y
D SIGNAL

C A P A C I T Y   A N A L Y S I S

GR /M	ADJ FLOW RATE	HMSV LT FLOW	ADJ SAT FLW RT	FLOW RATIO	CRIT ?	GREEN RATIO	LN GR CAPACITY	V/C RATIO
	407	0	1524	0.267	N	0.580	884	0.460
R	407	0	1304	0.312	N	0.580	75.	0.538
T	575	0	1070	0.537	Y	0.580	621	0.926
	717	0	1144	0.497	N	0.580	838	0.856
	901	0	481	0.302	N	0.360	1073	0.840
R	610	0	1503	0.406	Y	0.360	541	1.128

ENGTH : 100.0 SUM OF CRITICAL LANES' FLOW RATIOS : 0.943
ME PER CYCLE : 6 INTERSECTION V/C : 1.003

L E V E L   O F   S E R V I C E

ER /M	V/C RATIO	GREEN RATIO	CYC LEN	1st DELAY	LN GR CAP	2nd DELAY	PF	LN GR DELAY	LN GR LOS	APP DELAY	APP LOS
T	0.460	0.580	100	9.1	884	0.3	0.85	8.0	B		
TR	0.538	0.580	100	9.7	756	0.6	0.85	8.8	B	8.4	B
LT	0.926	0.580	100	14.5	621	14.4	0.85	24.6	C		
T	0.856	0.580	100	13.3	838	6.2	0.85	16.6	C	20.1	C
L	0.840	0.360	100	22.3	1073	4.3	1.00	26.6	D		
TR	1.128	0.360	100	26.2	541	77.3	0.85	88.0	F	51.4	E

INTERSECTION DELAY : 30.5 secs/veh
LEVEL OF SERVICE : D

ATTACHMENT 2*:

CAPACITY FLOWS AT THE CLARENDON STREET/
COLUMBUS AVENUE INTERSECTION

* Source: HMM Associates.

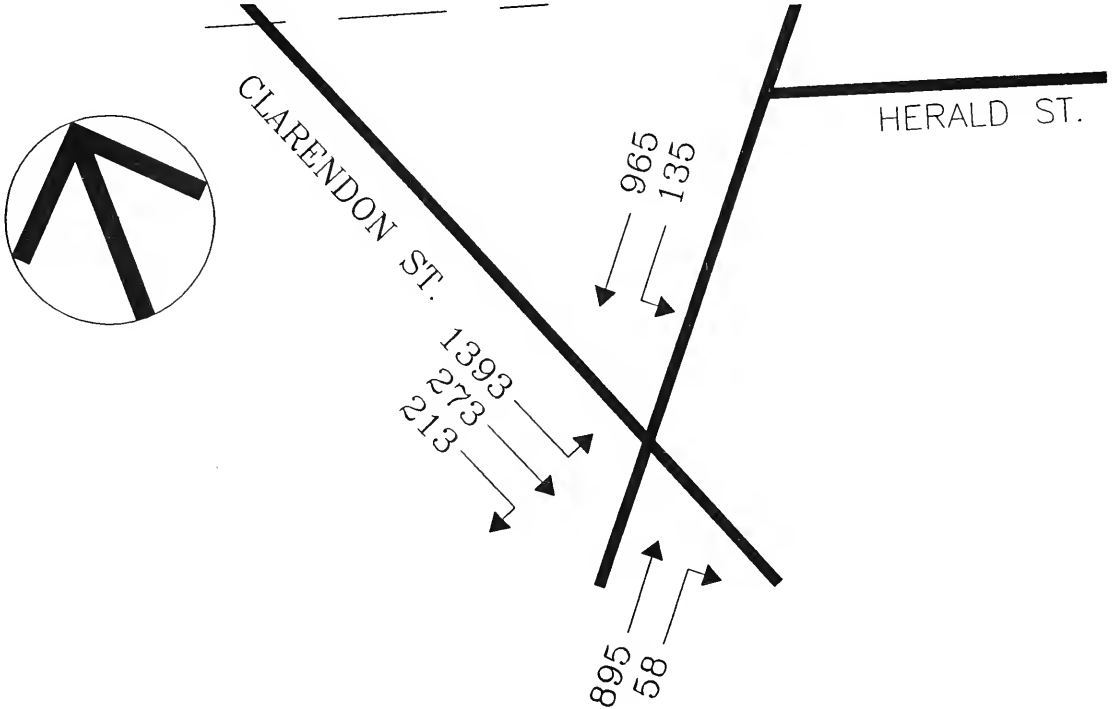


FIGURE 3
2010 MAXIMUM CAPACITY TRAFFIC VOLUMES
PM PEAK HOUR

CTION #
AVE. @
ON ST.
PM PEAK HOUR 10 NB LL MAX CRDGY
SIGNAL

T R A F F I C & R O A D W A Y C O N D I T I O N S

GRADE (%)	HV (%)	ADJ. Y/N	PKG LN. Nm	SUSFS (Ub)	PHF	CONF. PEDS (peds/hr)	PED BUTTON Y/N	PED BUTTON SEC	ARR TYPE
0	0	Y	10	0	0.89	0	Y	11.5	3
0	4	Y	10	0	0.87	0	Y	7.2	3
0	0	N	0	0	0.90	0	N	0.0	3
0	0	N	0	0	0.89	0	Y	17.0	3

D E C M F T R I C S / V O L U M E S

VOLUME LT	VOLUME TH	VOLUME RT	LANE GROUPS 1 MVM	1 LNS	1 WD	2 MVM	2 LNS	2 WD	3 MVM	3 LNS	3 WD
0	995	58	T	1	11.0	TR	1	12.0			
135	965	0	LT	1	14.0	T	1	14.0			
0	0	0									
393	273	213	L	2	24.0	TR	1	12.0			

S I G N A L P H A S I N G

PHASE	1ST MV	2ND MV	3RD MV	PROT	PMSV	G	Y+R
2	T	TR		R		42	58
1	LT	T		L		5	95
3	LT	T			L	42	58
5	L	TR		LR		47	53

V O L U M E A D J U S T M E N T

H	LANE GROUP MVM	FLOW RATE VOLUME	LANE UTIL IN GROUP	LANE UTIL FACTOR	ADJ FLOW RATE	PROP OF TURNS LT	RT
	T	500	562	1.00	562	0.00	0.00
	TR	453	509	1.00	509	0.00	0.13
	LT	475	546	1.00	546	0.28	0.00
	T	625	718	1.00	718	0.00	0.00
	L	1393	1565	1.00	1565	1.00	0.00
	TR	486	546	1.00	546	0.00	0.44

S A T U R A T I O N F L O W

IDEAL SAT FLOW	# OF LANES	ADJUSTMENT FACTORS WIDTH	H.V.	GRADE	PARK	BUS	AREA	RT	LT	ADJ. FLOW
1800	1	0.97	0.97	1.00	1.00	1.00	0.90	1.00	1.00	1524
1800	1	1.00	0.97	1.00	0.85	1.00	0.90	0.98	1.00	1310
1800	1	1.07	0.98	1.00	1.00	1.00	0.90	1.00	0.63	1070
1800	1	1.07	0.98	1.00	0.85	1.00	0.90	1.00	1.00	1444
1800	2	1.00	1.00	1.00	1.00	1.00	0.90	1.00	0.92	2981
1800	1	1.00	1.00	1.00	1.00	1.00	0.90	0.93	1.00	1513

CTION :
AVE. @
N ST.
PM PEAK HOUR 10 NB LL MAX CBD ? Y
SIGNAL

C A P A C I T Y   A N A L Y S I S

GR M	ADJ FLOW RATE	PMSV LT FLOW	ADJ SAT FLW RT	FLOW RATIO	CRIT ?	GREEN RATIO	LN GR CAPACITY	V/C RATIO
	562	0	1524	0.369	N	0.420	640	0.878
	509	0	1310	0.389	N	0.420	550	0.925
	546	0	1070	0.510	N	0.470	503	1.085
	718	0	1444	0.497	Y	0.470	679	1.057
	1565	0	2981	0.525	Y	0.470	1401	1.117
	546	0	1513	0.361	N	0.470	711	0.768

NGTH : 100.0 SUM OF CRITICAL LANES' FLOW RATIOS : 1.022
E PER CYCLE : 9 INTERSECTION V/C : 1.123

L E V E L   O F   S E R V I C E

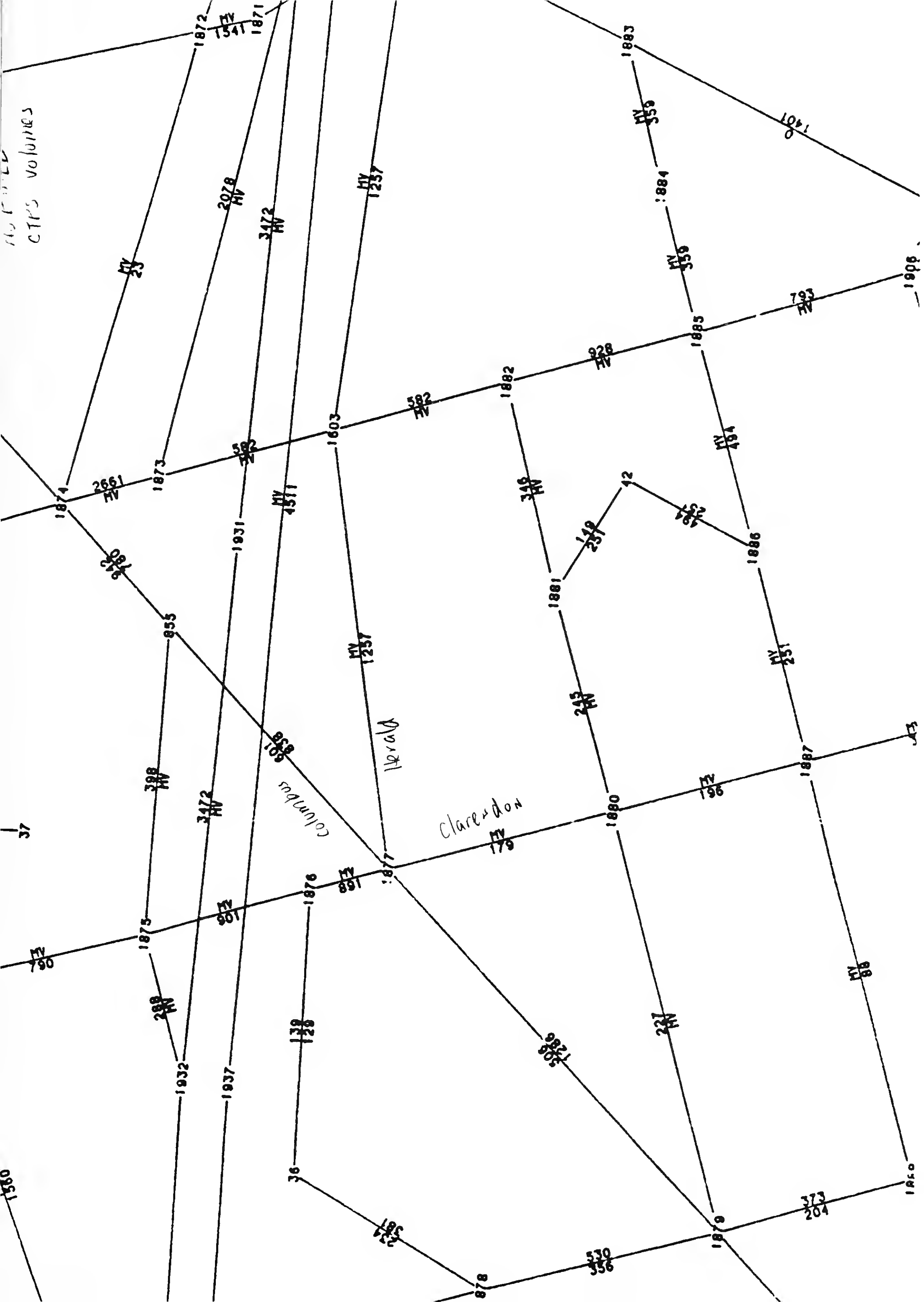
GR M	V/C RATIO	GREEN RATIO	CYC LEN	1st DELAY	LN GR CAP	2nd DELAY	PF	LN GR DELAY	LN GR LOS	APP DELAY	APP LOS
	0.878	0.420	100	20.3	640	9.3	0.85	25.2	D		
R	0.925	0.420	100	20.9	550	15.6	0.85	31.0	D	27.9	D
T	1.085	0.470	100	21.8	503	58.9	0.85	68.6	F		
	1.057	0.470	100	21.2	679	43.4	0.85	54.9	E	60.8	F
	1.117	0.470	100	22.5	1401	60.4	1.00	82.9	F		
R	0.768	0.470	100	16.7	711	3.5	0.85	17.2	C	65.9	F

INTERSECTION DELAY : 55.3 secs/veh
LEVEL OF SERVICE : E

ATTACHMENT 3*:

YEAR 2010 VOLUMES FROM CTPS

* Source: Central Transportation Planning Staff.

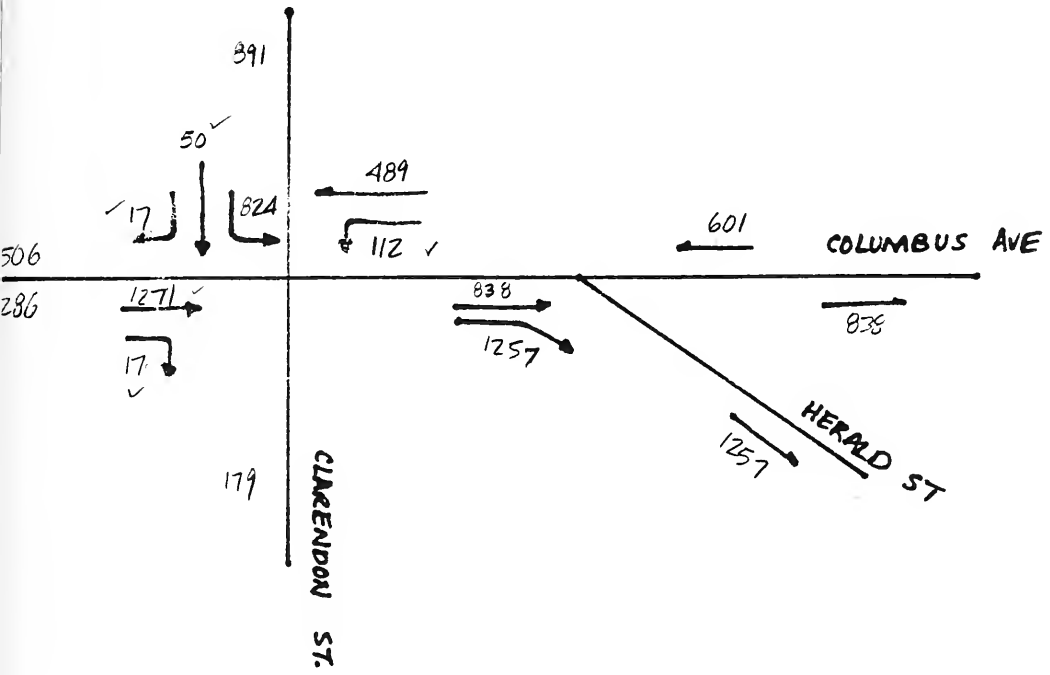


CTPS volumes
Herald
Columbus
Clarendon

HMM ASSOCIATES, INC.
ENGINEERS, ENVIRONMENTAL CONSULTANTS & PLANNERS

PROJECT HERALD ST. PROJECT #3003
SUBJECT AM 2010 NO BUILD

JOB NO.
SHEET NO. ___ OF ___
DATE 1-12-09
COMP. ___ CHECK ___



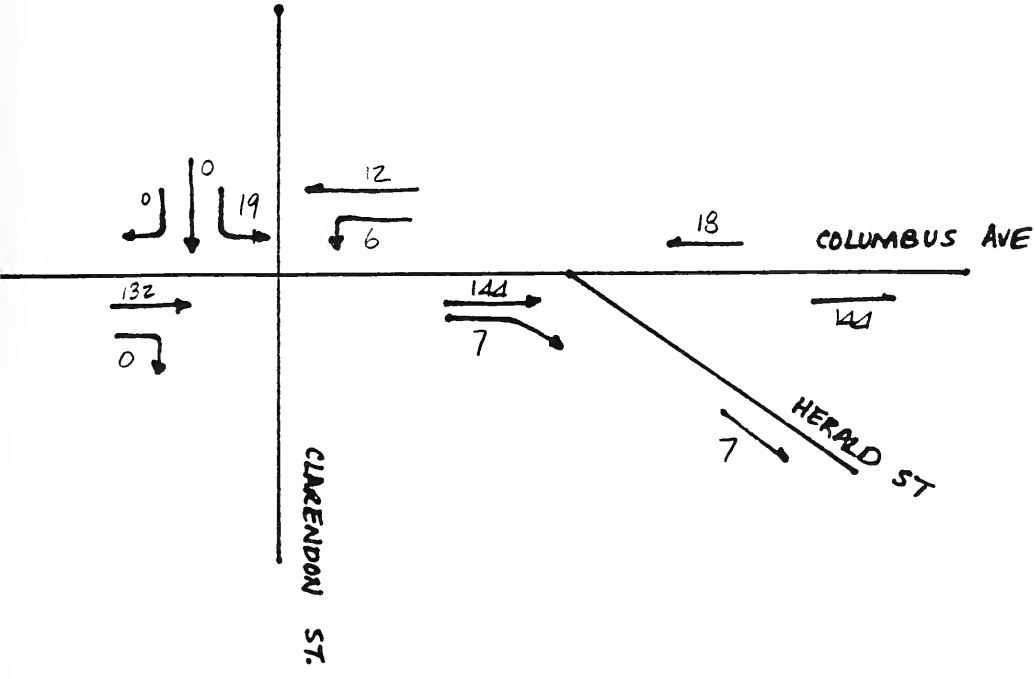
1) 601 to 506 must be a [illegible] of 100 + [illegible] over 179. SB
2) 50, 17 are estimates

FIGURE

HMM ASSOCIATES, INC.
ENGINEERS, ENVIRONMENTAL CONSULTANTS & PLANNERS

PROJECT HERALD ST. PROJECT #3003
SUBJECT AM SITE TRIPS NO OVERPASS

JOB NO.
SHEET NO. ___ OF ___
DATE 1-12-09
COMP. ___ CHECK ___

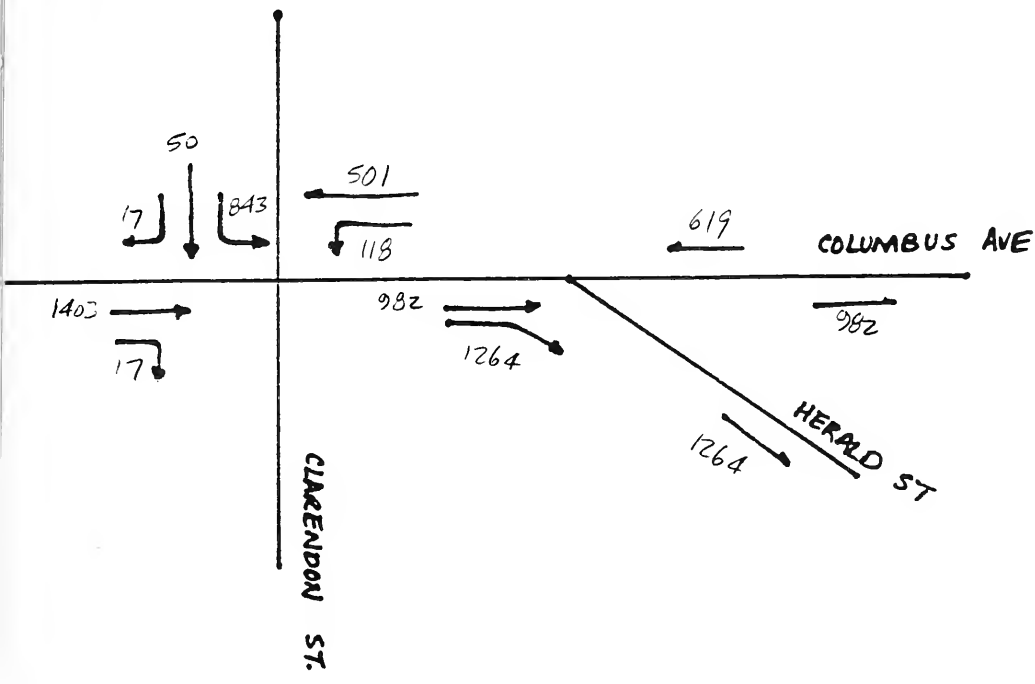


FIGURE

HMM ASSOCIATES, INC.
ENGINEERS, ENVIRONMENTAL CONSULTANTS & PLANNERS

PROJECT HERALD ST. PROJECT #3003
SUBJECT AM 2010 Build

JOB NO.
SHEET NO. OF
DATE 1-12-09
COMP. CHECK



FIGURE

ERSECTION :
UMBUS AVE. @
RENDON ST.
:DAY AM PEAK HOUR 10 MILLION CBD'Y
JATED SIGNAL

T R A F F I C & R O A D W A Y C O N D I T I O N S

P	GRADE (%)	HV (%)	ADJ. PKG	PKG MN. Nm	BUSES (NO)	PHF	CONF. PEDS (peds/hr)	PED BUTTON Y/N	PED BUTTON SEC	APP TYPE
.	---	---	---	---	---	---	---	---	---	---
B	0	8	Y	10	0	0.89	0	Y	10.5	3
B	0	4		10	0	0.87	0	Y	9.5	3
B	0	0	N	0	0	0.90	0	N	0.0	3
:	0	0	N	0	0	0.89	0	Y	17.0	1

G E O M E T R I C S / V O L U M E S

P	VOLUME LT	TH	RT	LANE GROUPS 1 MVM	LNS	WD	2 MVM	LNS	WD	3 MVM	LNS	WD
EB	0	1405	17	T	1	11.0	TR	1	12.0			
WB	118	501	0	LT	1	14.0	T	1	14.0			
NB	0	0	0									
SB	843	50	17	L	2	25.0	TR	1	12.0			

S I G N A L P H A S I N G

PP	PHASE	1ST MV	2ND MV	3RD MV	PROT	PMSV	G	Y+R
EB	1	T	TR		R		54	46
WB	1	LT	T			L	54	46
NB	2	LT	T		L		5	95
SB	3	L	TR		LR		31	69

HANCOCK DEVELOPMENT 10AM.LL

RSECTION :
MBUS AVE. @
ENDON ST.
DAY AM PEAK HOUR 10 B LL HER CBD / Y
ATED SIGNAL

V O L U M E A D J U S T M E N T

EACH MVM	LANE GROUP VOLUME	FLOW RATE IN GROUP	LANE UTIL FACTOR	ADJ FLOW RATE	PROP OF TURNS LT	RT
T	760	854	1.00	854	0.00	0.00
TR	660	742	1.00	742	0.00	0.05
LT	118	126	1.00	126	1.00	0.00
T	501	576	1.00	576	0.00	0.00
L	843	947	1.00	947	1.00	0.00
TR	67	75	1.00	75	0.00	0.25

S A T U R A T I O N F L O W

MVM	IDEAL SAT FLOW	# OF LANES	ADJUSTMENT FACTORS WIDTH	H.V.	GRADE	PARK	BUS	AREA	RT	LT	ADJ. FLOW
T	1800	1	0.97	0.97	1.00	1.00	1.00	0.90	1.00	1.00	1524
TR	1800	1	1.00	0.97	1.00	0.85	1.00	0.90	1.00	1.00	1330
LT	1800	1	1.07	0.98	1.00	1.00	1.00	0.90	1.00	0.18	306
T	1800	1	1.07	0.98	1.00	0.85	1.00	0.90	1.00	1.00	1444
L	1800	2	1.02	1.00	1.00	1.00	1.00	0.90	1.00	0.92	3040
TR	1800	1	1.00	1.00	1.00	1.00	1.00	0.90	0.96	1.00	1559

RSECTION :
IMBUS AVE. @
RENDON ST.
DAY AM PEAK HOUR 10 B LL HFR CBD ? Y
DATED SIGNAL

C A P A C I T Y   A N A L Y S I S

LN GR MVM	ADJ FLOW RATE	PMSV LT FLOW	ADJ SAT FLW RT	FLOW RATIO	CRIT ?	GREEN RATIO	LN GR CAPACITY	V/C RATIO
T	854	0	1524	0.560	Y	0.540	823	1.038
TR	742	0	1330	0.558	N	0.540	718	1.033
LT	136	0	506	0.444	N	0.590	181	0.751
T	776	0	1444	0.399	N	0.590	852	0.676
L	947	0	3040	0.312	Y	0.310	942	1.005
TR	75	0	1559	0.048	N	0.310	483	0.155

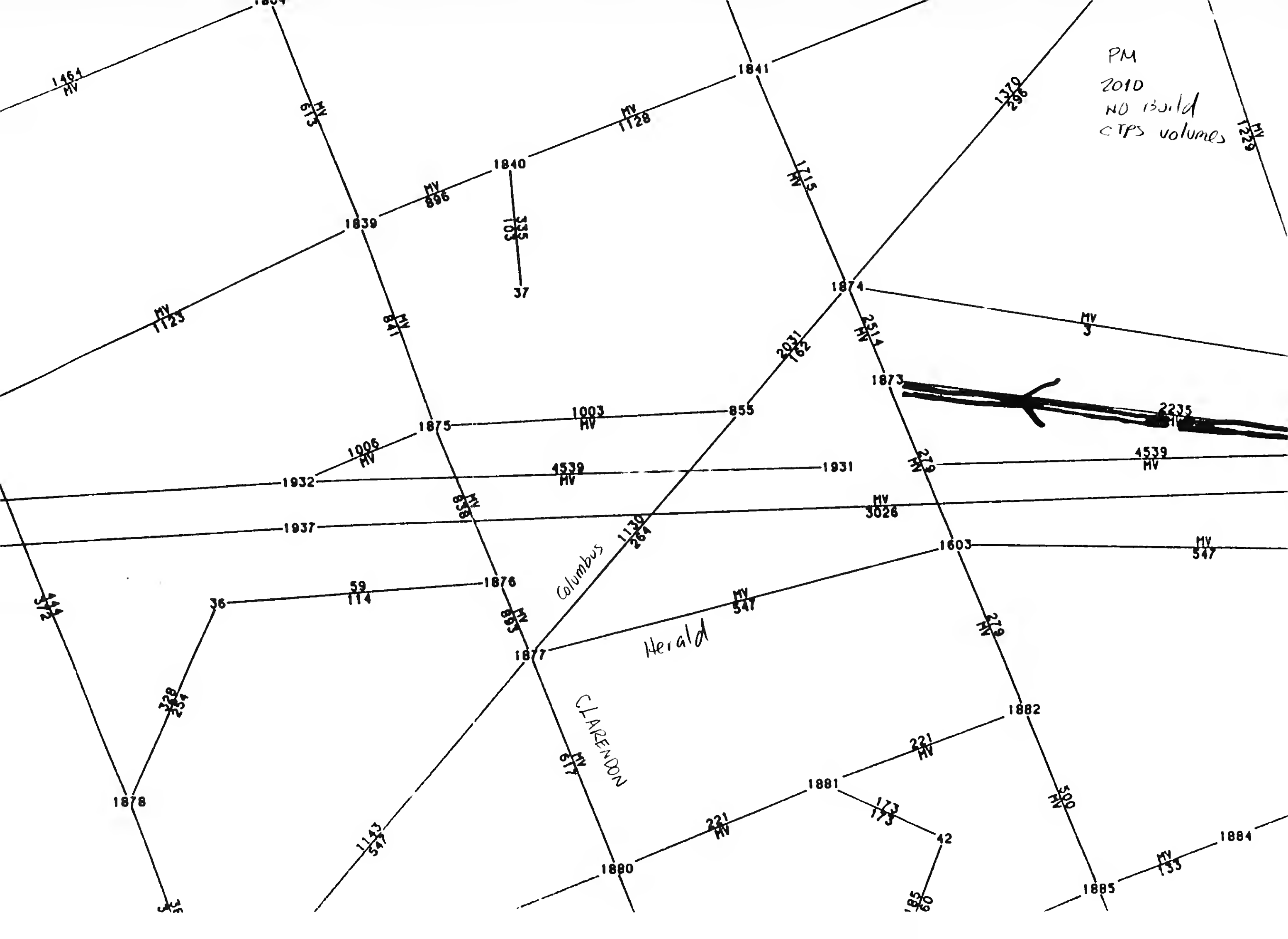
E LENGTH : 100.0
TIME PER CYCLE : 9

SUM OF CRITICAL LANES' FLOW RATIOS : 0.872
INTERSECTION V/C : 0.958

L E V E L   O F   S E R V I C E

LN GR MVM	V/C RATIO	GREEN RATIO	CYC LEN	1st DELAY	LN GR CAP	2nd DELAY	PF	LN GR DELAY	LN GR LOS	APP DELAY	APP LOS
T	1.038	0.540	100	18.3	823	34.5	0.85	44.9	E		
TR	1.033	0.540	100	18.2	718	34.8	0.85	45.0	E	44.9	E
LT	0.751	0.590	100	11.5	181	10.7	0.85	18.9	C		
T	0.676	0.590	100	10.6	852	1.5	0.85	10.3	B	11.9	B
L	1.005	0.310	100	26.3	942	23.7	1.00	50.0	E		
TR	0.155	0.310	100	19.0	483	0.0	0.85	16.1	C	47.5	E

INTERSECTION DELAY : 38.6 secs/veh
LEVEL OF SERVICE : D


PM
2010
NO Build
CTPS volumes
Herald
CLARENDON
Columbus

HMM ASSOCIATES, INC.

ENGINEERS, ENVIRONMENTAL CONSULTANTS & PLANNERS

JOB NO.

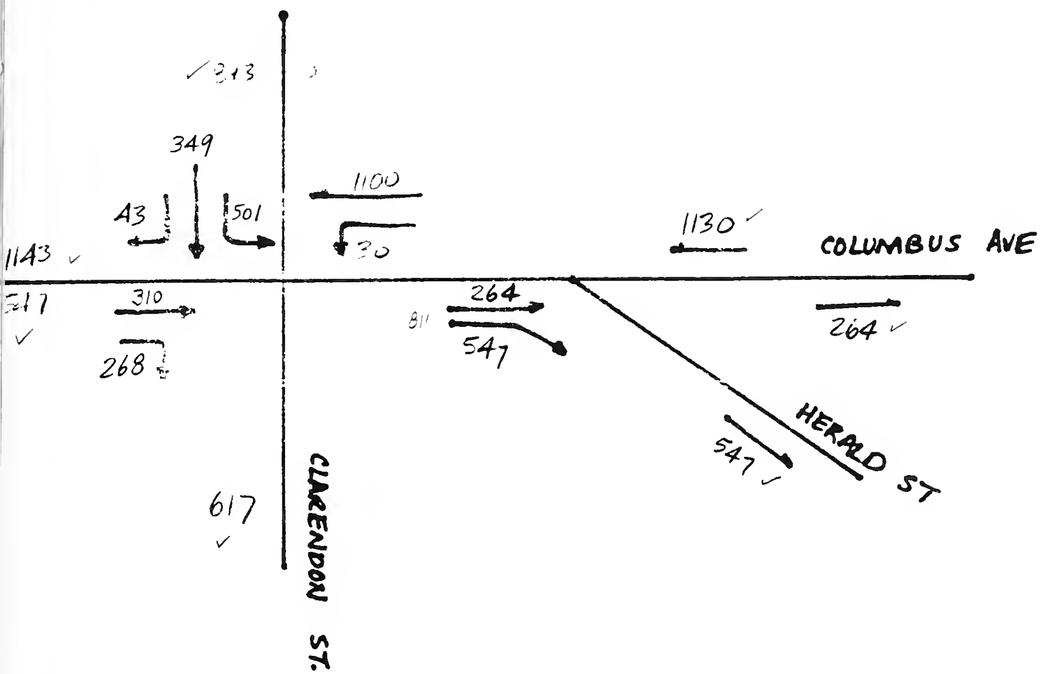
SHEET NO. OF

PROJECT HERALD ST. PROJECT #3003

DATE 1-12-89

SUBJECT PM 2010 NO BUILD

COMP. CHECK



Assumpt. = 1130 to 1143
1101 1100
thus
LT
43 LT 1143 WB

2) (893 / 893+547) × 811 = 501 LT

310 must be SB thru

3) 893 - 501 - 43 = 349
349 + 268 = 617 ok.

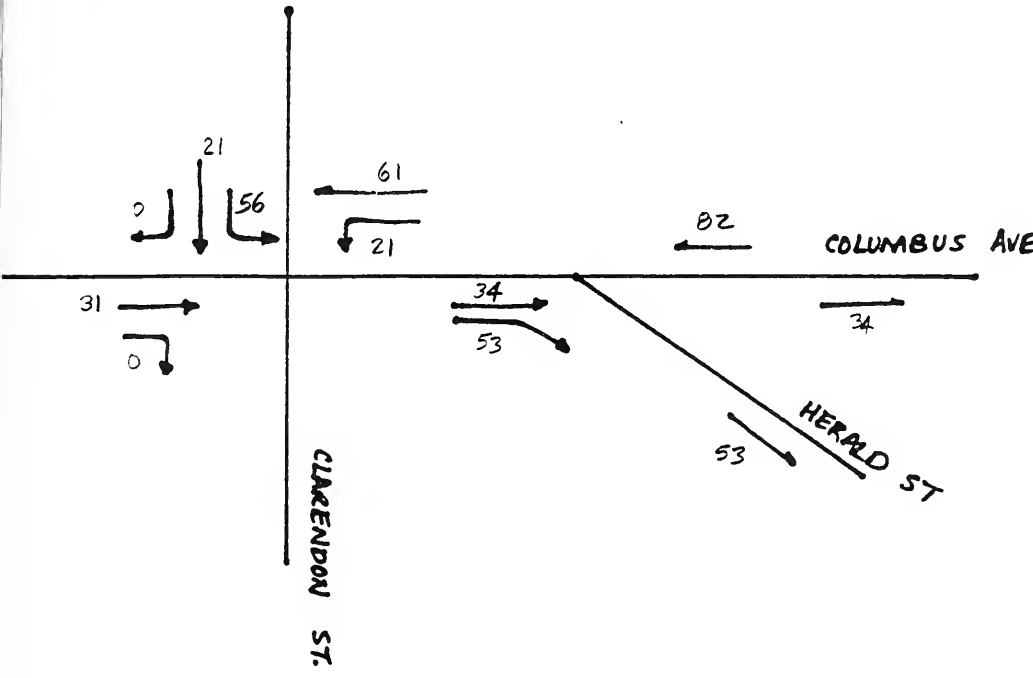
4) 300 + 265 = 578 high
ok. to run.

FIGURE

HMM ASSOCIATES, INC.
ENGINEERS, ENVIRONMENTAL CONSULTANTS & PLANNERS

PROJECT HERALD ST. PROJECT #3003
SUBJECT PM SITE TRIPS NO overpass

JOB NO.
SHEET NO. ___ OF ___
DATE 1-12-09
COMP. ___ CHECK ___

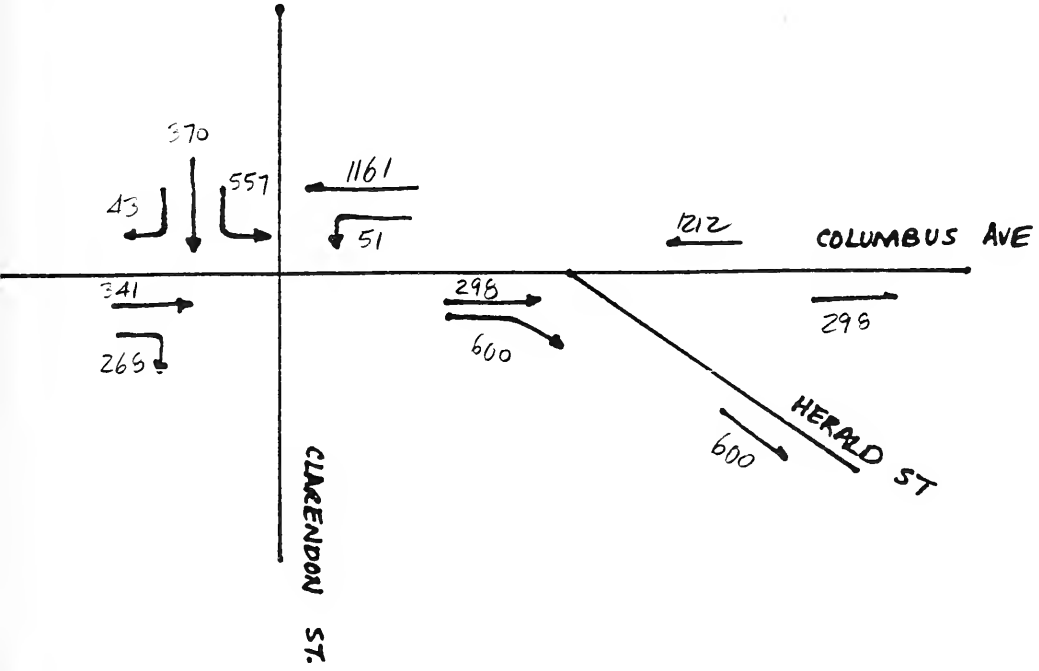


FIGURE

HMM ASSOCIATES, INC.
ENGINEERS, ENVIRONMENTAL CONSULTANTS & PLANNERS

PROJECT HERALD ST. PROJECT #3003
SUBJECT PM BUILD 2010

JOB NO.
SHEET NO. ___ OF ___
DATE 1-12-09
COMP. ___ CHECK ___



FIGURE

ERSECTION :
JMBUS AVE. @
RENDON ST.
DAY PM PEAK HOUR 10 R LL HFR CRD?Y
JATED SIGNAL

T R A F F I C & R O A D W A Y C O N D I T I O N S

P	GRADE (%)	HV (%)	ADJ. PKG LN. Y/N	Nm	BUSES (Nb)	PHF	CONF. PEDS peds/hr	PED BUTTON Y/N	SEC	ARR TYPE
B	0	8	Y	10	0	0.89	0	Y	12.5	3
B	0	4	Y	10	0	0.87	0	Y	9.2	3
B	0	0	N	0	0	0.90	0	N	0.0	3
B	0	0	N	0	0	0.89	0	Y	17.0	3

G E O M E T R I C S / V O L U M E S

P	VOLUME LT	TH	RT	LANE GROUP 1 MVM	LNS	WD	LANE GROUP 2 MVM	LNS	WD	LANE GROUP 3 MVM	LNS	WD
EB	0	341	268	T	1	11.0	TR	1	12.0			
WB	51	1161	0	LT	1	14.0	T	1	14.0			
NB	0	0	0									
SB	357	370	43	L	2	25.0	TR	1	12.0			

S I G N A L P H A S I N G

PP	PHASE	1ST MV	2ND MV	3RD MV	PROT	PMSV	G	Y+R
EB	1	T	TR		R		54	46
WB	1	LT	T			L	54	46
WB	2	LT	T		L		5	95
SB	3	L	TR		LR		31	69

HANCOCK DEVELOPMENT 108PM

ERSECTION #
UMBUS AVE. &
RENDON ST.
DAY PM PEAK HOUR 10 B LI HER CBD ? Y
UATED SIGNAL

V O L U M E A D J U S T M E N T

OACH	LANE GROUP MVM	VOLUME	FLOW RATE IN GROUP	LANE UTIL FACTOR	ADJ FLOW RATE	PROP OF TURNS LT	RT
	T	305	343	1.00	343	0.00	0.00
	TR	304	342	1.00	342	0.00	0.88
	LT	606	697	1.00	697	0.03	0.00
	T	606	697	1.00	697	0.00	0.00
	L	557	626	1.00	626	1.00	0.00
	TR	413	464	1.00	464	0.00	0.10

S A T U R A T I O N F L O W

MVM	IDEAL SAT FLOW	# OF LANES	ADJUSTMENT FACTORS WIDTH	H.V.	GRADE	PARK	BUS	AREA	RT	LT	ADJ. FLOW
T	1800	1	0.97	0.97	1.00	1.00	1.00	0.90	1.00	1.00	1524
TR	1800	1	1.00	0.97	1.00	0.85	1.00	0.90	0.87	1.00	1159
LT	1800	1	1.07	0.98	1.00	1.00	1.00	0.90	1.00	0.94	1597
T	1800	1	1.07	0.98	1.00	0.85	1.00	0.90	1.00	1.00	1444
L	1800	2	1.02	1.00	1.00	1.00	1.00	0.90	1.00	0.92	3040
TR	1800	1	1.00	1.00	1.00	1.00	1.00	0.90	0.97	1.00	1596

HANCOCK DEVELOPMENT 10PM PK

ERSECTION :
URBUS AVE. &
RENDON ST.
:DAY PM PEAK HOUR 10 % LT HER CBD ? Y
DATED SIGNAL

C A P A C I T Y A N A L Y S I S

LN GR MVM	ADJ FLOW RATE	PHSV LT FLOW	ADJ SAT FLOW RT	FLOW RATIO	CRIT ?	GREEN RATIO	LN GR CAPACITY	V/C RATIO
T	343	0	1824	0.225	N	0.540	823	0.417
TR	342	1	1159	0.295	N	0.540	626	0.546
LT	697	0	1597	0.473	N	0.590	942	0.740
T	677	0	1444	0.483	Y	0.590	852	0.818
L	626	0	2040	0.206	N	0.310	942	0.665
TR	464	0	1596	0.291	Y	0.310	495	0.937

S LENGTH : 100.0 SUM OF CRITICAL LANES' FLOW RATIOS : 0.774
S TIME PER CYCLE : 0 INTERSECTION V/C : 0.851

L E V E L O F S E R V I C E

LN GR MVM	V/C RATIO	GREEN RATIO	C/C LEN	1st DELAY	LN GR CAP	2nd DELAY	PF	LN GR DELAY	LN GR LOS	APP DELAY	APP LOS
T	0.417	0.540	100	10.4	823	0.2	0.85	9.0	B		
TR	0.546	0.540	100	11.4	626	0.8	0.85	10.4	B	9.7	A
LT	0.740	0.590	100	11.3	942	2.2	0.85	11.5	B		
T	0.818	0.590	100	12.3	852	4.4	0.85	14.2	B	13.8	B
L	0.665	0.310	100	22.8	942	1.3	1.00	24.1	C		
TR	0.937	0.310	100	25.5	495	18.5	0.85	37.4	D	29.7	D

INTERSECTION DELAY : 17.9 secs/veh
LEVEL OF SERVICE : C